

PAINT PEEL OFF- A NUISANCE IN AUTOMOTIVE PROPELLER SHAFT ASSEMBLY

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ABSTRACT

Manufacturing an automotive propeller shaft is really a challenging process. The propeller shaft consists of many sub components known as sub-assemblies. The sub components like Stub yoke, Flange Yoke, Sleeve Yoke, Tube, Split Spline Shaft, Mid Slip Shaft, Bearing Cup, Cross etc. As the propeller shaft is located beneath the Automobile, a little attention is given towards its aesthetic appearance. The propeller shaft is coated and painted with paint and phosphate, which is mostly carried out in the paint booth [3]. The main reason is to reduce the warranty issues and enhance the life of it and also to avoid premature failure during when the propeller shaft is in operation.

KEYWORDS: Paint Peel Off, Propeller Shaft Assembly & Paint Booth Issues

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INTRODUCTION

The functionality and the efficiency are the important criterion of each and every manufactured component; which is manufactured through the systematic process. The life and service span of the components plays a major role in the organization which wants to remain in the market competition. The aesthetic look of the propeller shaft is also one of the intolerable specifications of the quality. The painting is one of the facets of the propeller shaft. We have visited to some of the Automotive Propeller Shaft industries, especially their paint booths to find out loopholes and concerns affecting to the warranty of the components.

Generalized Process Flow for Painting Operation

The painting booth is an integrated part of the propeller shaft assembly section. The painting is performed with the standard manual spray painting process. The generalized process flow prior before and after the painting the propeller shafts in the propeller shaft assembly is given below.

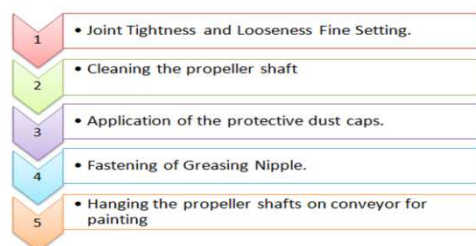


Figure 1: Process Flow for the Painting Operation

Joint Tightness and Looseness Fine Setting

This is the process generally carried out to set the degree of the tightness of looseness of the joint of the assembly parts i.e. stub yoke and flange yoke assembly in the universal joint assembly of the propeller shaft assembly. This process is mostly carried out to set the joint physical condition as per the standard control plan provided by the process engineering department. This is the preliminary operation for starting the painting operation.

If the joint is too loose; it will be difficult for the mounting the propeller shaft over the automobile and vice versa the condition; if the joint is too tight, the mounting can't be possible. This is the most skilled operation carried out by the experienced associates.

Cleaning the Propeller Shaft

After the completion of the very first process of pre painting treatment; the second process is started. The solution is the specially formulated liquid used for cleaning the propeller shaft. The debris and the grease which is stuck to the propeller shaft will be cleaned with this solution. The cotton cloth is used along with is solution to wipe the propeller shaft.

Application of the Protective Dust Caps

The protective dust caps are used to cover the grinded parts came with the lustrous shine. As per the control plan, no colour will be applied to these parts. The parts must be covered prior before painting operation.

Fastening of Greasing Nipple

The crosses linked to the bearing cups, the bearing cups are having the needle bearings; that needs to be lubricated for the better working of the propeller shaft. The purpose which is to serve and transmit the rotary motion between two concurrent shafts [4]. During this operation greasing nipples are fastened.

Hanging the Propeller Shafts on Conveyor for Painting

After completing the fastening operation; the propeller shafts to be hanged on the painting conveyor. They are hanged according to production plan. The painting conveyor is preset with the constant speed of 1m/min. The conveyor is running constantly and the painter associate will paint the propeller shaft according to the colour prescribed in the standard control plan, allotted for the specific propeller shaft. There will be another station just like the main paint booth station; so called as a touch-up booth, which is mostly used to touch-up the rest of the paint work remains during main paint booth operation.

Defects Associated with the Paint Booth in the Propeller Shaft Assembly

There is a scarcity of standardized operating procedures for the processes those are starting from the very first process to the last process; lots of defects associated with the painting operation are noted.

- Gloves and cloths of cotton; rubbed during the manual handling over the propeller shaft.
- Propeller shaft cloth cleaning and hand glove changing frequency is not decided.
- Cleanliness is absent in the pre painting stage and nearby stages. Conveyor cleaning frequency not decided
- Speed control mechanism absent for paint booth conveyor.

- Dust Cap is missing for the reverse sleeve yokes and etc.

As considered to the above listed defects and problems; it is clear that there will be a huge contribution of these all unconformities; resulting in paint peel off defect; which is a major concern of warranty issue. To work on these major issues, remedies are suggested and implemented, and results were monitored.

The Design of the Experiments for the Defects Identified in the Propeller Shaft Painting Operation

Experiment - 1

Root cause of the Problem- Absence of the training to the associates and missing standardized operating procedures.

Solutions Provided-

- Standardized operating procedures are prepared.
- Training sessions are arranged for the associates.
- Video graphic work instructions are prepared.

Standard Operating Procedures

The SOP's will help to ensure that the consistency and maintenance of certain desired standard systems in the production of a given product or the provision of certain services are attained and maintained.

The SOP refers to the instructions or the guidelines normally intended to document that how to perform a certain activity in a standard way. The key reasons, why the industries are opting for SOP's is to help them in guaranteeing that consistency and a certain quality of some products or services is to be maintained. They can also serve as very essential tools when one wants to operationalize and communicate key parameters.

The key parameters considered before designing the SOP's are

- Prerequisites considered are the control plan of the pre-painting stage.
- Scope Identified for all the associates of the propeller shaft assembly.
- Roles and responsibilities of the SOP followers.

Considering all the key parameters; the SOP prepared and implemented to the pre-painting stage of the propeller shaft assembly.

5. Standard Operating Procedure	Propeller Shaft Assembly	SDP #	2152
Department	Division-Production	Revision #	01
SDP Owner	R.H. Khandare	Approval	Supv. Manager - Production

Standard Operating Procedure

- Purpose** - "Gloves and cloths of cotton; rubbed during the manual handling over the propeller shaft"
- Scope** - All the FTE's, GT's and Permanent Employees
- Prerequisites** - Control Plan for the Pre paint operation.
- Responsibilities** - All the FTE's, GT's and Permanent Employees
- Procedure**-
 - The cotton gloves must not be used to handle the propeller shaft after cleaning.
 - The gloves changing frequency decided to every week instead of 15 days.
 - The "Hansel" solution must not spill on the shop floor during cleaning the propeller shaft.

Documents: SDP for Paint Shop - Propeller Shaft Assembly

Figure 2: Sample of Standard Operating Procedure

Experiment - 2

The root cause of the Problem - "Dust Cap is missing for the reverse sleeve yokes".

Detailing of the Problem - Polyvinyl chloride dust caps missing during product birth to the delivery to the customers.

Impact of the Problem

- Chances of the damages to the reverse sleeve yokes after polishing operation.
- Parts are getting dusty; which will result in the major oil leakages; while assemblage with the engine at the customer ends.
- All hazardous issues related to mishandling and misplacing.

Source of the Problem

- Skipping of the dust cap at the following stations;
 - Polishing Station (Yoke Line)
 - Inspection Station (Yoke Line)
 - Stacking Station (Assembly Line)
 - Co2 Welding Station (Assembly Line)
 - Straightening Station (Assembly Line)
 - Propeller Shaft balancing Station(Assembly Line)

- Painting Station (Assembly Line)
- Skipping of the dust caps while transportation from one station to another station. The main reason is looser fitting of the dust caps; resulting in getting rid of the caps out of the reverse sleeve yoke.

Solution Provided

- Dust Cap Design is to be Modified for the Better Fitment as Follows.

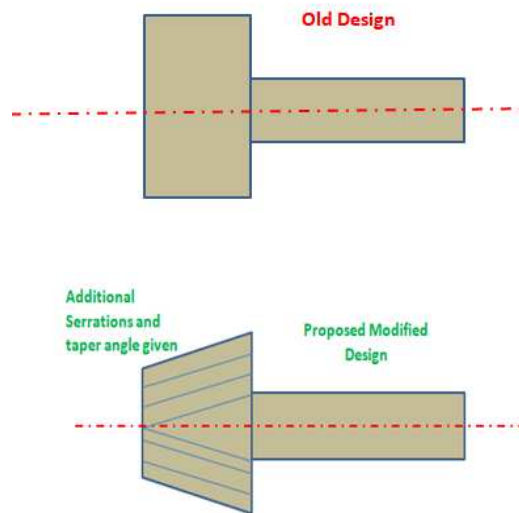


Figure 3: Old and Proposed Design of the Dust Cap

- Additional caps to be provided to each related workstation for better planning to stop skipping of the dust caps.
- Awareness program and training to the associates to be given to their understanding towards to the criticality of the issue.

For Enhancing the Morale and the Workability of the Associates Following Actions are taken:

- Preparation of Video Graphic Work Instructions;
 - Providing only SOP doesn't be effective all the time, hence working jointly with the production officials. The project of making the video graphic work instructions are prepared for the propeller shaft assembly to train the newly joined associates.
 - Aspects covered during preparing the video graphic work instructions.
 - Information on the Machine tools in detail
 - Information about fixtures, tooling's, spanners etc.
 - Information about the Personal Protecting Equipment [5].
 - The importance of the critical parameters associated with the parts.
 - Standard Operating Procedures [6].
 - Breakdown and remedy.

- Preventive Maintenance [7].
- Total Productive Maintenance.
- Machine Utilization card detailing.
- Training Sessions arranged for the associates

The training sessions are arranged for the associates after the lunch break and before starting the production work. The main motto behind this training was to motivate the associates for doing things correctly. Also, the most important factor was to eliminate the wastes.

RESULTS AND DISCUSSIONS

The paint peel off issue was the main warranty issue, which lowers the assembly line efficiency; the paint peel off during the transportation for one unit to the other unit was also one of the major concerns. It was later rectified by modifying the storage and transport racks.

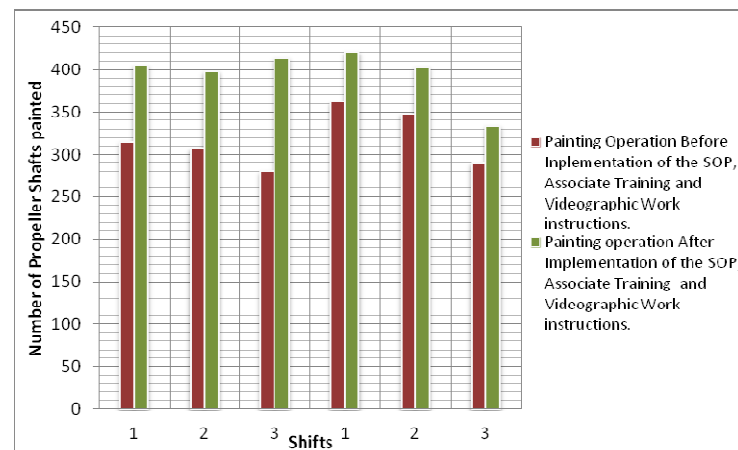


Figure 4: Number of Shifts Vs Number of Propeller Shafts Painted.

After implementation of the standard operating procedures, video, graphic work instructions and training, best results are noted. Also, it enhanced the morale of the associates.

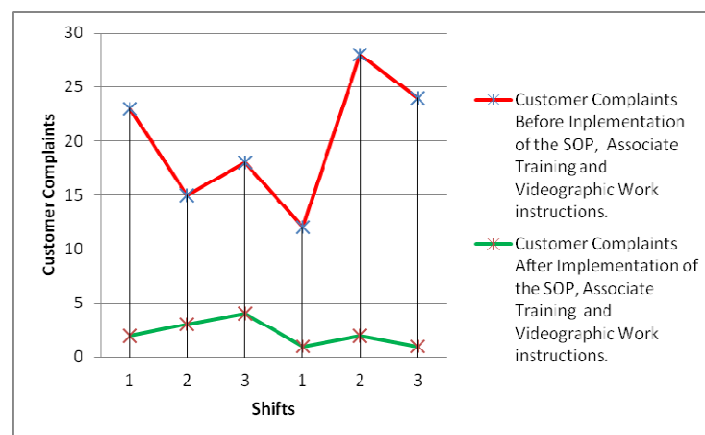


Figure 5: Number of Shifts Vs Number of Customer Complaints

CONCLUSIONS AND FUTURE SCOPE

A major work has been carried out in the propeller shaft assembly with the productivity enhancements along with the increased morale of the associates. It is observed in the propeller shaft assembly line that if the associates are properly trained, it will enhance the morale of the workers, resulting in optimizing productivity, better work flow [2] and quality concerns will also lower drastically.

Even if the Lean tools [1] and logics of the Agile manufacturing tools are applied for proving their efficiency with optimizing the productivity and throughout the time in the propeller shaft assembly specially in the painting area, still there is a vast scope in this field to achieve the target PPM levels.

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